Calculations indicate that under the usual assumed bound charge conditions, an induced voltage wave high enough to cause insulator flashover can result only from a rapid collapse of the electrostatic field of the cloud. Accordingly, this must involve a traveling wave of steep front or of short effective duration. A steep wave front would also occur with a surge imposed on a conductor by a direct stroke to it. The maximum voltage wave that can travel on the line and reach the apparatus is determined by the line insulation. The waves in practise are generally non-oscillatory and have a wide variety of shapes. However, the waves usually causing insulator sparkover give an impulse ratio of the order of two (2.0), and indicate an effective duration of 1 to 20 microseconds above the 60-cycle flashover value.

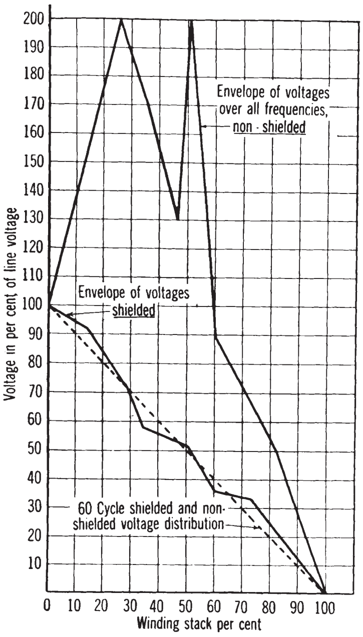

Fig. 24—Voltage Distribution at all Frequencies of Shielded and Non-Shielded Transformers

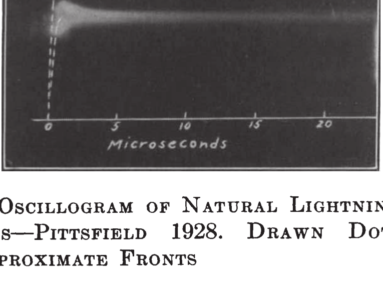

Fig. 27—Oscillogram of Natural Lightning Made on Short Lines—Pittsfield 1928. Drawn Dotted Lines Indicate Approximate Fronts

The Ground Wire. Statistical data still confirm the value of the ground wire. These data indicate that outages due to insulator arc-overs are reduced from one-half to one-tenth or more after the installation of the ground wire.

Lightning Proof Transmission Lines and Coordination of Transformer Insulation and Line Insulation

The ideal line would be as low in height as practicable, be protected by one or more ground wires, and be well insulated with insulators protected by grading shields. The transformer insulation should be somewhat stronger than the bushing flashover voltage, which in turn should be higher than the flashover voltage of the insulators in the immediate vicinity of the line. By immediate vicinity is meant that the coordinated insulation should start within 75 ft. of the apparatus and preferably extend out at least one-half mile. Such arrangement of the insulation should not increase outages. As a precaution, extra ground wires may be added on the coordinated section to provide against local disturbances. However, where the line is badly exposed to direct strokes special precaution should be taken in the design of the tower so that side flashes are not likely to take place from ground wire to conductor. Rods might be used and special precautions taken as to length of span, ground resistance, distance from conductor to ground wire, etc. Extra ground wires in sections may be necessary to assure immunity against direct strokes.

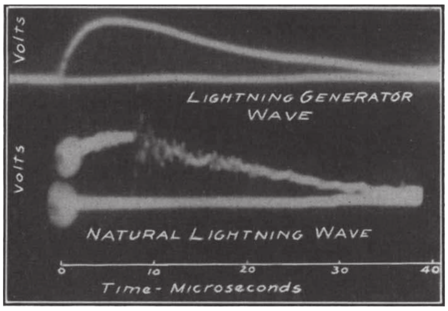

Fig. 28—Comparison of Natural Lightning Wave Measured on Transmission Lines with Cathode Ray Oscillograph with an Artificial Lightning Wave Measured in the Same Way

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FARADAY CENTENARY IN 1931

Preliminary plans for the celebration of the centenary in 1931 of Faraday's epoch-making discoveries are reported by the *Electrical World* to have been made in London at a meeting of representatives of scientific, electrical and other societies held at the Royal Institution under the presidency of Sir Arthur Keith. The time chosen provisionally for the celebrations was the third week in September, 1931, and it was decided to set up two small committees, representing the scientific and industrial interests, to make the necessary plans and to insure that the celebrations shall be attended by interested persons from all parts of the world.